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FOR THE

ERADICATION OF HOOKWORM DISEASE

HOOKWORM DISEASE

Its Ravages, Prevention and Cure

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Hookworm in sections in which it prevails is one of the most common, most insidiously harmful, and most easily prevented diseases known to man. It causes human suffering and economic waste altogether out of proportion to its apparent death-rate. Many ills which have been attributed to mental and moral weakness of whole bodies of people are now definitely known to be due to this infection, and curable with its cure. Its eradication is one of the most important and pressing problems before the people of the southern half of the United States and of other semitropical and tropical lands. Moreover, the progress which has been made in recent years completely demonstrates at once the vast benefit, in terms both of human happiness and of industrial efficiency, attendant on stamping out of the disease, and also the complete adequacy, in stamping it out, of perfectly simple precautions prescribed by the primary rules of health and even of common decency.

WHERE HOOKWORM DISEASE IS FOUND

Hookworm disease is found more or less prevalent in the entire zone lying within 30 degrees north and 30 degrees south of the equator, or in practically all the tropical and semitropical countries, in which are more than half the people of the globe. In many of these countries this anemia-producing infection is extremely

prevalent, in a severe form. In Porto Rico and the low-lying districts of Colombia, and in many of the sugar plantations of Ceylon and Dutch Guiana, for example, infection was found to involve 90 per cent. of the entire population. Since 1904 more than 300,000 persons have been treated for hookworm disease in Porto Rico, with the result that, whereas in 1900 and 1901 the deaths from anemia numbered 11,875, or 33.2 per cent. of the total deaths in the island, and in 1902 and 1903, after some treatment for hookworm, 6,830; they had fallen in 1904 and 1905 to 4,693, and continued to decrease until they were in 1906 and 1907 only 1,134, and in 1907 and 1908, 1,785. The majority of Porto Ricans, long noted for laziness and shiftlessness because of this anemia, are now known to have been the victims of a specific infectious disease; the wholesale treatment of which is revolutionizing the island, and bringing health and prosperity where almost universal misery and poverty reigned.

✓ In the United States, the disease is found throughout the states south of the Potomac and Ohio rivers, in Arkansas, Missouri, Oklahoma, and Texas, and also in California. Its prevalence and severity vary widely within the state and even in a county, in some localities less than 1 per cent. of the people being infected, and in others more than 90 per cent. Generally speaking, the heaviest infection is found on the light, sandy soil of the coastal plains, the lightest infection on the stiff, clay soil of the Piedmont region, and an intermediate infection among the foothills and mountains. It is peculiarly a disease of the agricultural districts, which goes far to explain the long-puzzling lack of physical and intellectual vigor to be noted among large classes of people in what ought to be one of the healthiest and most prosperous sections of the country (Figs. 1, 2 and 3). Examination of more than 415,000 school children during the four years 1910-1913 in 413 counties of the eleven Southern states has revealed 43 per cent. of them infected. Of more than 700,000 persons of all ages taken at random in the same territory, 35 per cent. were found to be suffering from this disease, and in a vast majority of cases were completely cured. 

When individual treatment has been accompanied by simple sanitary reforms to prevent reinfection, most

noteworthy benefits have been derived by entire communities. For example, in the camps of the Continental Coal Corporation, at Pineville, Ky., where 1,800



Fig. 1.—D. C. of Grant County, Ark., aged 16, practically an invalid from childhood, has been treated for malaria and tuberculosis. She was found heavily infected with hookworms and was given treatment.

men were on the company's pay-rolls, in June, 1911, about 65 per cent. were infected with hookworm, there were about 150 cases of typhoid, and cases of bowel

complaint were numerous. Soil pollution through lack of sanitary water-closets was practically universal, the water-supply was contaminated, and flies had free range. Measures were taken to eradicate the hookworm by providing sanitary closets, which stopped soil pollution and prevented flies from carrying the infection back into the houses, and the water supply was also safeguarded. As a result, in the year following, the same force of men loaded over 33 per cent. more coal on the cars than they did in the year before. Also there was not a single case of typhoid in the camps during the summer of 1912, and cases of diarrhea were reduced to about one-half.

HOW THE HOOKWORM AFFECTS ITS VICTIMS

For generations hookworm disease has been insidiously spreading unrecognized and unchecked over the countries of the globe having a mild climate. Its victims, numbering many millions, have through centuries, no doubt, been hosts to the small blood-sucking intestinal parasite which causes the disease. Their strength has been sapped, their vitality lowered, their physical and intellectual growth stunted. They have been mastered in war, commerce and industry by the more hearty people of colder latitudes to the north. The social and economical importance of the disease is therefore almost beyond comprehension. The infection is in most instances so insidiously acquired by the unsuspecting victim that he and the members of his family, who are probably likewise being infected, do not know just when the effects of the disease began to manifest themselves. In the course of a few summers, however, a once healthy family has become pale and puny; a once industrious family has become languid and backward in its work; a once prosperous family has fallen into debt; a once proud family, owning valuable property, has been reduced by an easily curable and easily preventable disease to tenancy and to poverty. The children, once bright and well advanced in their school classes, begin to lose their zeal and their mental alertness when gradually robbed of their vitality. They fall behind in the struggle with their healthier classmates, and, finally discouraged and perhaps abused, give up school work in despair.

GREAT ECONOMIC LOSS DUE TO THE HOOKWORM

This is no exaggerated picture of the harm wrought by the disease. The economic loss already stated in



Fig. 2.—D. C. as she is to-day.

the case of the Kentucky coal-miners is to be found wherever the disease prevails. The physically sound coffee-picker in Porto Rico picks from 500 to 600 measures of coffee a day. Dr. Wickliffe Rose reports

that he found scores of infected men there who could pick only from 100 to 250 measures a day, and the manager of one of the great haciendas, or plantations, told him that the disease had reduced the average efficiency of labor on the coffee estates to from 35 to 50 per cent. of normal. One of the largest cocoa plantations in Ecuador reports that 300 laborers on the place were so reduced by the anemias of hookworm and malaria as to be able to do not more than one-third of a reasonable day's work. The manager of a large British Guinea sugar estate reports that treatment for hookworm has doubled the working power of the gangs. A single California mine employing over 300 men is estimated to have lost 20 per cent. of the wages paid, or \$20,000 a year, because it had to carry on the pay-roll a large body of men to replace those periodically unable to work because of hookworm anemia. In the South Atlantic and Gulf states the infection is heavier than in California, and the loss on the farms and in the cotton factories is enormous. The weavers in the Southern mills are not naturally inferior to the European immigrants who operate the New England looms. Their labor is less efficient in some instances because vast numbers of them are victims of the hookworm. The Southern farms are not lacking in fertility, nor are their owners, whose fathers fought under Lee and Jackson, lacking in sterling virtues; but thousands of men and women with the best blood of the land in their veins are made improvident and slothful by this infection, and the hundreds of cases in which these supposed faults of character have been reformed by hookworm treatment prove beyond question the enormous moral and economic cost of the disease.

GROWTH OF CHILDREN RETARDED

Hookworm retards the development of children to a remarkable degree. School and college records show that infected students, even though not apparently ill, average lower in their studies than those found free from infection. In one woman's college the average standing of fifty-six girls found infected was 77.75 per cent., whereas fifty-six girls taken at random from those in the institution found free from infection averaged 89.28 per cent. Similarly in an academy, a group of twenty-five infected men and boys averaged 64 per



Fig. 3.—Effects of hookworm disease: *A*. Small boy is H. M. of Heber Springs, Ark., called “Chalky,” from the extreme pallor of his face. “Chalky” is 18 years old, weighs 82 pounds, and uses chewing tobacco, snuff and, profane language. He is uncle of the larger boy, is two months older and 50 pounds lighter than his nephew, who is not infected. *B*. Three heavily infected children, aged 13, 9 and 7 years, of Wise County, Va. The boy was treated for consumption. Twenty grains of thymol brought 234 hookworms, a dwarf tapeworm and almost complete recovery. *C*. Boy, I. S., of Stokes County, N. C., severely infected. Note the “angel wings” shoulder-blades and the “pot-belly,” characteristic symptoms.

cent., and a non-infected group beside them averaged 86 per cent. Teachers in all parts of the South report marked improvement in zeal and intelligence, as well as in weight and physical appearance of children immediately on being freed from the parasites. One case from the field director of the hookworm campaign in Prentiss County, Miss., may be given as fairly typical of the experience of physicians in this work.

"A young man that we treated furnished us the best recommendation that we could have had. He came to the office about the third week looking as if he had an advanced case of tuberculosis, and with a cough that appeared serious. He was such a picture of dejection, misery and lost hope, that he attracted the attention of the whole court-house crowd and many of them watched eagerly to see the results of the examination. One man asked me after he left, if I could cure him, and I replied that we would do our best. This man then kindly stated that he thought that I was doing the boy an actual wrong by holding out hope, as it was his belief that the boy would die in a very short time. This boy was instructed to return every week for his treatment until informed that he was cured. He did; and it was a standing request by the court-house officials that they be called each week as W. L. came in, so that they could see for themselves whether he was improving or not. On his first trip, one week later, he came in, and there was evidence of much improvement. He came in with a smile, showing more interest in things around, telling jokes to fellows in the office, when just one week before he had stood listless without a word to any one except to answer 'yes' or 'no' when a question was put to him. He informed us that on this trip, although he had taken his medicine only a week ago, he was feeling a great deal better; and when placed on the scales, I found that he had gained a number of pounds in weight. He was given three treatments, one week apart, and after waiting two weeks following the third treatment, he was found free from infection, and weighed 18 pounds more than he did previous to the first treatment. On the day that he first appeared at the dispensary he could hardly walk, and the last time that I saw him he started with another boy to walk 7 miles to his home."

THE PENALTY OF IGNORANCE AND NEGLECT

Such facts, of which hundreds of the same import might be cited, show the heavy price which the people of the South have been paying in loss of money, health

and intellectual power, for ignorance and carelessness concerning a disease which is easily diagnosed, easily cured and easily prevented. It is due solely to neglect of sanitation which permits the eggs of the small intestinal worms which pass with the excreta from the bowels of infected persons to find lodgment on the soil, and then hatch into infective larvae ready to carry the disease to some other human being or reinforce the infection of the original victims.

There is no other disease perhaps which is so well understood in every detail, and which can be so satis-

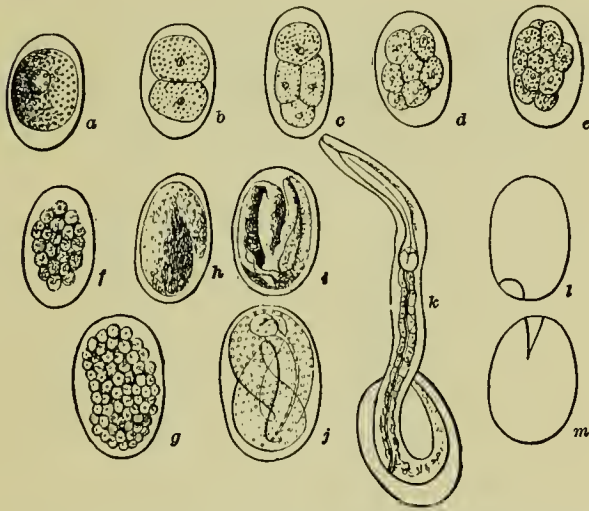


Fig. 4.—Development of Old-World hookworm: *a-g*, changes occurring in egg preparatory to developing of little worm; *h-k*, stages of the worm's development until it emerges from the egg-shell; *l, m*, empty egg-shells; greatly enlarged. (After Peroncito. Courtesy of C. V. Mosby Publishing Company.)

factorily explained to a layman. Nor is there any other widely prevalent disease against which the lay community can so readily and surely protect itself by simple precautions. Its conquest virtually resolves itself into a problem of education against soil pollution.

The largest possible public therefore should be brought to know in detail the history of hookworm disease; the distribution and life cycle of the parasite causing it; its symptoms, method of cure, and, most important of all, means of absolute prevention.

HOW HOOKWORM DISEASE WAS FOUND

Hookworm disease is not new. It is only newly understood. The symptoms of the disease were described in the records of the Egyptian Empire, but its cause was not known. The hookworm itself was discovered in 1838 by Dr. Angelo Dubini, an Italian, who while making a necropsy found the small white worm with its head buried in the membrane of the small intestine; but that this worm had anything to do with anemia was not suggested. When, however, in 1877, Grassi, another Italian physician, identified the eggs of this worm in the feces of anemic patients, it was suspected that the parasite was the cause of the disease. About the same time, Dr. Colomiatti, studying an obscure disease which had caused the death of many workmen on the St. Gothard Tunnel, discovered in the intestine of one of the tunnel victims more than fifteen hundred hookworms. This parasite, known as the Old World hookworm and named *Ankylostoma duodenale*, was carefully studied, its responsibility for certain types of anemia in Southern Europe demonstrated, and successful treatment for the disease developed.

The prevalence of hookworm disease in the New World was not recognized till much later. Nov. 24, 1899, Major Bailey K. Ashford of the United States Army Medical Corps, while treating anemia supposedly due to starvation caused by the hurricane in Porto Rico, identified the hookworm as the real cause of the wide-spread disease. He, however, supposed the parasite found by him to be the Old World type. In 1902 Dr. C. W. Stiles of the United States Public Health Service, having found the same disease in the Southern States, identified its cause as a different species of worm, now known as the New World type, or *Necator americanus*. It was then discovered that the worm found in Porto Rico was of this species.

Subsequent discovery of the same worm as the cause of anemia among the victims of the African lowlands suggests that the so-called New World type was brought to Porto Rico and the Southern states by the slave trade. This form also prevails in India, and has been carried to Jamaica, Trinidad and British Guiana by the Hindoo coolies brought there as laborers. The

disease caused by one or the other of the two types of hookworm is now known in practically all tropical or semitropical countries, but all the worms look alike to everybody except the expert zoologists; they produce practically the same symptoms; substantially the same treatment is effective with all, and they can all be prevented by the same means.

HOW THE HOOKWORM LIVES AND WORKS

The hookworm in adult life is a small, round intestinal parasite about $\frac{1}{3}$ inch in length, and about the



Fig. 5.—Slice of skin as seen under the microscope. Note how the younger hookworms are crawling through the skin. This is how "ground-itch" or "dew-itch" looks. (U. S. P. H. Service.)

size of No. 30 sewing thread. As a type it is found to infect man and numerous animals, such as the dog, the fox and the cow; but the particular species infecting man have not been found in animals, nor those of the lower animals in man. Only the type infecting man will be discussed here.

The life of the hookworm is made up of two periods. During the first period the worms are microscopic in

size and live in the soil. It is in the soil that they hatch from microscopic eggs (Fig. 4) which were deposited there with the excrement from some person having hookworm disease. Neither the eggs nor the larval worms hatching from the eggs can be seen with the unaided eye. These minute worms will live for perhaps ten or twelve months under favorable conditions of warmth and moisture; but they cannot develop beyond this point unless they gain entrance into the body of some human being and find their way into the intestinal canal, usually the upper portion of the small intestine. The drying heat of the sun and the freezing weather of winter are destructive both of the development of the hookworm eggs and to the life of the larvae. For this reason the disease is rare in deserts and in countries having protracted cold weather. A porous, sandy loam soil, having reasonable shade, affords the most favored habitat for the hookworm larvae. Though in stiff clay soil conditions are much less favorable to these little worms, we often find that enough of them have lived and entered into the second period of their life's existence to cause heavy infection.

The second period of the hookworm's life is spent within the body of a human being. The great majority of the worms never reach this stage in their development. In fact, many of the eggs never hatch. Yet when we stop to consider that in some localities 90 per cent. of the people are severely infected, and that each infected person will daily cast off with the excreta from one to four million eggs on the soil, we can appreciate that even with this loss it will be almost impossible for one to escape infection in a section where wastes from the human body are not properly disposed of.

With these facts before us we at once want to know how these invisible filth-borne pests find their way to our small intestines. The answer may be a short story, but generally it is a long one.

It may be short because the little worms may cling to food which is swallowed by the unsuspecting victim. They may be carried on soiled hands; or, perhaps more frequently, may be swallowed along with uncooked foods, such as strawberries, plums, celery and lettuce,



Fig. 6.—Tennessee family, all infected. All were cured with thymol. They had spent \$1,500 for patent medicines.

grown in or left to lie on ground polluted by human excreta.

Though some infection is thus taken through the mouth, the most of it is acquired through the skin in a very interesting way. In brief, this is the story of the hookworm's most common progress: Within a week of the hatching of the larvae they molt and shed their skin twice. They are protected by the second sheat, and are very tough. In this stage they possess the wonderful ability to burrow (Fig. 5) in a few minutes through the skin and to enter the tiny blood capillaries, where, carried along by the blood-current, they make a long journey through the body to the heart and to the lungs. In the lungs the blood-vessels are too small to permit them to pass through, so they begin to burrow again, and soon find themselves in the air-spaces of the lungs. Crawling along these they reach the wind-pipe and then the throat. Once there the worms are swallowed with saliva and food, and thus by this long journey find their way to the intestine, where they fasten on its walls and begin their blood-sucking.

One would think that the hookworms would have great difficulty in penetrating the skin and the blood-vessels in the lung, yet they do it. The fact can be easily demonstrated by experiment. If the polluted soil in which the larvae are known to be is moistened and applied to the skin, the point at which they enter will become inflamed and an eruption will appear, which is commonly known to the barefoot boys and girls as "ground-itch." Moreover, by the end of eight weeks, examination and treatment will show the person to be harboring adult hookworms, even though it may have been demonstrated that he was not infected up to the time he was brought in contact with the polluted soil. It should be remembered that the presence of "ground-itch" or "dew-itch," even though the skin may heal quickly, usually means that hookworms have entered the body and are beginning to rob the victim of his blood and vitality.

The second period in the life history of the hookworms begins with their entrance into the intestinal canal. There the male and female worms, after molting twice again, develop to adult life. From five to

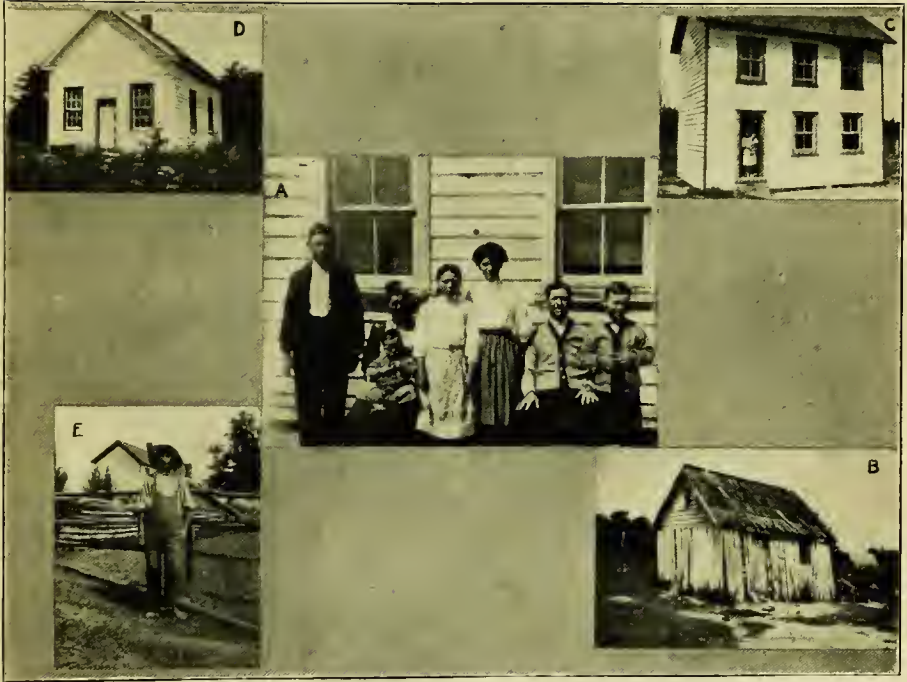


Fig. 7.—Results of treatment. A. Prescott family, Richmond County, Va.; whole family found heavily infected in 1910. The mother had never known a well day; father was doing about half work, the oldest boy almost none. No one of these children, no member of their parents' family, or their grandparents' family, or their great grandparents' family on either side had ever gone to school. Photograph made nearly two years after treatment. B. House in which the children were born and in which the family had lived up to the time of treatment. C. House which the family built and moved into about fourteen months after treatment. D. School which children are now attending. E. Boy at fence has made a good crop. He and his father are now using their muscle and energy to bring the family into a prosperity never before known.

eight weeks is usually required for their growth. When grown they may usually be seen with the unaided eye. At this stage they fasten on the wall of the intestine, live for many years, and do the harm to be described next. Besides this the females deposit thousands of eggs, which, being mixed with the excreta, pass out on the ground to spread the disease.

Now that we have followed the complete life cycle of the parasites, let us study the disease caused by the adult worm in the intestine.

THE EFFECTS OF HOOKWORM DISEASE

When we consider that several hundred hookworms may live in the intestine at one time, and that they may live there for from six to ten years—sapping the blood, wounding the intestine, and poisoning the body—it is not strange that the body becomes diseased. The blood is needed to collect oxygen in the lungs and the food from the intestine, and distribute them over the body. In the disease much blood is lost. Some of it is taken into the bodies of the worms, and a great deal more is lost by bleeding from the small wounds made by the worms. In severe cases of the disease, the blood is reduced to one-fourth or one-sixth of what it should be. In such cases we find the victim's normal color replaced by a pale, sallow complexion; the lips are pale; the mucous surfaces generally are pale, and the skin is of a pale, yellowish hue. The eyes are listless, the pupils dilated and not very responsive to light; often they present a blank stare, fish-like in character. The hair is dry and scant, especially in the armpits. The face and the ankles are often swollen, anemic ulcers frequently appear on the legs, and the abdomen is prominent, giving rise to the term "pot-belly." The chest is flat, and the shoulder blades stand out prominently, suggesting "angel wings." When the disease occurs during the growing period there is a marked retardation in development; that is to say, a boy or girl may not be developed at 18 beyond what would be expected of one at 13 or 14 years of age. The appetite is often perverted, so that the sufferer has a craving for a particular kind of food, and often for certain substances not foods. For example, victims of the disease frequently crave clay, and for this reason are termed "dirt-eaters." Again, coffee-grounds or salt may be the substance desired.

The intestinal wall is considerably damaged by the worms, and becomes tender to pressure over the pit of the stomach. Where the worms bite, raw surfaces are



Fig. 8.—Showing dwarfing effect of the disease. These boys are brothers, Jones County, Miss. No. 1, age 17, weight 156 pounds; light infection. No. 2, age 18, weight 74 pounds; heavy infection.

left, so that it is easy for any germs, such as may cause typhoid fever or tuberculosis, to get into the body and set up a disease more violent in character,

and more frequently fatal, than hookworm disease. There may be severe headaches, lassitude, dizziness and inability to sleep. The heart is poorly nourished by the impoverished blood, yet it is called on to do the work necessary to keep the body supplied with oxygen from the lungs and food from the digestive tract. As a result, the heart's action becomes labored, so that hookworm disease is frequently mistaken for heart-disease or Bright's disease. Most of these cases can easily be cured by getting rid of hookworms.

It must not be inferred that every person who is infected with hookworms suffers with all the symptoms mentioned. Much of the infection is so mild that the presence of the disease might not be suspected. In cases of medium severity one or more of the symptoms will be present, but the existence of the disease cannot be confirmed until the eggs of the worms are demonstrated in the excreta by microscopic examination.

The disease, however, even in very mild cases, is a menace for two reasons: First, any infection exerts a handicapping influence on the victim. This has been shown among students who, though mildly infected, were underdeveloped in size and were backward in their studies; and, being below the standard, they were more subject to other diseases. Second, the persons mildly infected are carriers and distributors of the hookworm eggs, and may become responsible for the disease in a severer form in themselves and in other persons.

HOW HOOKWORM DISEASE SPREADS

We have seen how each of the female hookworms living in the intestines deposits hundreds—often from twelve to fifteen hundred—of eggs daily; that these eggs do not hatch while they remain in the bowel, but after they have passed out on the soil, where there is moisture and warmth—but not too much—they hatch into larvae. Both the eggs and larvae are too small to be seen with the naked eye. The larvae remain invisible in size unless they can get into the intestine, which they may reach by being swallowed with food or by entering the skin, usually of the feet, there producing “ground-itch” or “dew-itch,” and then making a long journey through the body until the intestine is reached.

When infected persons go from place to place they spread the infection. It is thought that the negro slaves brought the disease to America from the West Coast of Africa. Likewise, the disease may be carried from one community to another. Suppose we have a school district at A where there is no infection, and the people are healthy and thrifty; and from



Fig. 9.—Showing dwarfing effects of hookworm disease. a. B. brothers, Forest County, Miss. Smaller infected; said to be 21 years old; weight 66 pounds. Larger not infected; 17 years old; weight 126 pounds.

this community the son and daughter of Mr. Jones visit the Smiths in the distant community of B, where 75 per cent. of the residents have hookworm disease, and the soil is teeming with the larvae; that is to say,

there is heavy soil pollution. Neither the Smith nor the Jones family pays much attention to the use of privies; indeed, there is much doubt if either has one; for out of 189,586 rural homes in the Southern states inspected by the Rockefeller Sanitary Commission, 95,988 were found to have no privies at all and 87,156 to have open privies which allowed wastes to spread freely through the soil. The sun is warm, and the Jones children go barefooted and contract "ground-itch." They eat strawberries and plums which have been on the ground. By the time their visit is over they have become infected with grown hookworms. Returning, they begin to pollute the soil at their home. The other members of the Jones family get the infection, and by the end of the summer they are all becoming pale and puny. The district school at A opens. The Jones children, though not in their usual health, go to school. The school has been equipped with many of the modern conveniences, but has not been provided with privies. The need of them was not really felt. The boys concealed themselves in woods and undergrowth to the east, and the girls to the west of the schoolhouse. The Jones children, not knowing they have a disease, of course, do not know they are spreading one when they use the common hiding-grounds. In ignorance of the disease and in ignorance of sanitation, which the school should be teaching in a practical way, the soil around the school becomes heavily polluted, and a center for spreading the disease from one family to another. Soon the community has hookworm disease. Sometimes every pupil in a school gets it. The people become sick, backward, lazy, poverty-stricken and "trifling"; no one seems to suspect when, how or why "hard times" overtook the community. Had there been sanitary privies in use by all the people of the district, the disease would have been limited to the two Jones children, and their infection would have been mild. This is so, because when the hookworm eggs are collected in a sanitary privy they never reach the soil where, by hatching into larvae, they can do the harm.

HOW THE DISEASE IS RECOGNIZED

Hookworm disease is recognized with certainty in two ways. If it is suspected from the clinical symp-

toms already described, the treatment, which is very simple and inexpensive, may be given. If the disease exists, the worms which cause it will be poisoned and dislodged by the medicine, and may be found in the

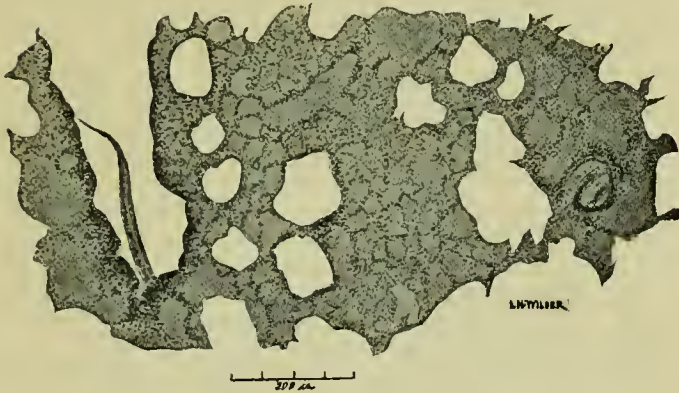


Fig. 10.—This shows two young hookworms in the lungs. The worm on the left is entering the air tubes. (P. H. & M. H. Service.)



Fig. 11.—Here we see two young hookworms in the larynx (Adam's apple). The worms pass to the intestine (bowels) and again take food and grow, shedding their skin two more times. P. H. & M. H. Service.)

stools. By washing the stools through one or two thicknesses of cheese-cloth, the worms will be left on the cloth, and may be seen and collected with ease.

The second method is the one commonly employed. Nearly a million persons have been examined in eleven Southern states by its use during the last four years. A small portion of the bowel movement is spread out thinly in water on a glass slide, and placed under a microscope. If the hookworm eggs, which are very characteristic in shape and size, are found, it is known that the hookworms are in the bowel, and that treatment for their removal should be taken. Hundreds of the best people, men, women and children in the South, are seeking examination by this method, and are putting aside all squeamishness in the determination to rid themselves and their communities of this pest.

HOW HOOKWORM DISEASE IS PREVENTED

There are two ways to get rid of hookworm disease: one is to prevent it, the other to cure it. Unfortunately as a people we are slow to apply preventive measures against disease. This means that we have too much disease, and, of course, that we rely too much on treatment. Preventive measures against hookworm disease are very simple. All that is necessary is to have the excreta of every person collected and disposed of in a way which will keep the hookworm egg from developing. If this should be done in every case, the hookworms, not multiplying in the intestine, would die in a few years of old age and the disease would become extinct.

Until this can be accomplished much infection can be prevented by wearing shoes. The barefoot boy is a great gatherer of hookworms. But the really effective protection from the disease is to be found in clean soil. That can be secured when sanitary privies are constructed and regularly used by all the people. Even if those persons now infected should refuse treatment, but could be induced or required to use sanitary privies, the country would in a few years be freed from the disease.

The common pollution of the ground about schools and farmyards must be stopped. The tumble-down shack and surface privy which allow their contents to be spread over the soil, by rains, hogs and chickens, or carried by flies to the houses, must be abolished, and replaced everywhere by the sanitary privy, the essentials of which are that it have a water-tight, fly-

screened receptacle, and that the contents be disposed of in a sanitary way, by burning, fermenting, or burying away from and below the water-supply. Human excrement should not be used as a fertilizer unless thoroughly treated under competent direction; otherwise it may carry hookworms to fruit and vegetables.



Fig. 12.—Experimental Hookworm Infection. Shows confluent vesicle (blister) formation with slight decrease of swelling. (Photograph furnished by Dr. Claude A. Smith, Courtesy of C. V. Mosby Pub. Co.)



Fig. 13.—This shows the head of a hookworm as the parasite is feeding, attached to the wall of the bowels. (P. H & M. H. Service.)

An inexpensive privy which can be easily provided for the most simple farm or cottage has watertight pails, tightly closed in, close-fitted door, and all

openings covered with wire mesh to exclude flies. Many communities are already putting in such privies, and there is a growing movement for placing them in every rural schoolyard of the South as a protection against hookworm, typhoid and other diseases.

All plans for privies approaching the ideal thus far presented seem to be too expensive or otherwise unpractical. The feeling is growing that some practical arrangement should be recommended, even though from the point of view of the idealist it is not without danger. We know that trains, automobiles and elevators are dangerous to a degree, yet no one would be so foolish as to advise that we avoid the use of these conveniences of civilization until the element of danger is absolutely eliminated. Working on this principle, sanitarians are now recommending as a minimum for a privy, first that a hole be dug in the ground; second, that a substantial box with a hole in the bottom be turned upside down over the hole in the ground and dirt banked around the lower edge of the box; third, that the hole in the box be covered when not in use; fourth, that the box be moved from time to time and the pit filled up with dirt. This privy may be built out in the bushes or it may be within expensively constructed walls. For all practical purposes an arrangement of this kind will eliminate hookworm eggs as a source of danger, and so long as it is fly-proof it will guard against the spread of typhoid fever by flies. If located a reasonable distance from the spring, or well, and below it, the danger of pollution is negligible, except perhaps in certain areas where the formation is largely limestone.

HOW HOOKWORM DISEASE IS CURED

Hookworm disease is usually treated with Epsom salts, and with powdered thymol given in capsules. The object of the Epsom salts is to free the intestine from mucus or other substances surrounding the hookworms and protecting them from the action of the thymol. The patient should take little or no supper on the evening before the thymol is to be administered. As early at night as is convenient he should take a dose of Epsom salt. The next morning as early as the salt has acted, half the number of capsules of thymol prescribed for the whole treatment should be taken.



Fig. 14.—E. J., Miss., age 21, weight 65, and J. N., age 10, weight 63 pounds.



Fig. 15.—B—— family, Kentucky. Severe infection. Fish eye. Extreme anemia. Dropsical.

Two hours later the remaining capsules should be taken. Two hours after the second dose of thymol, another dose of Epsom salt should be taken, which will expel the hookworms that have been forced to loosen their hold on the intestinal wall by the action of the thymol, and will also get rid of the excess of thymol before it has had time to produce any harmful effects on the patient. Nothing should be eaten on the day the capsules are taken until the final dose of Epsom salt has acted well. A little water or strong coffee, *without* milk, should alone be allowed.

As alcohol and oils dissolve thymol, making it actively poisonous to the patient, the use of them in any form would be exceedingly dangerous. Gravy, butter, milk, all alcoholic drinks and patent medicines, which generally contain alcohol, should be forbidden on the evening before and on the day of the treatment. Moreover, as many hookworm patients have dilated stomachs which do not readily empty themselves and it is important that the thymol reach the small intestine at once, the patient should lie on the right side for at least half an hour after taking each dose of thymol.

DOSE OF THYMOL

Age, Years	Grains	Grams	6 a. m.	8 a. m.
1 to 5.....	7.5	.5	$\frac{1}{2}$ dose	$\frac{1}{2}$ dose
5 to 10.....	15.	1.	$\frac{1}{2}$ dose	$\frac{1}{2}$ dose
10 to 15.....	30.	2.	$\frac{1}{2}$ dose	$\frac{1}{2}$ dose
15 to 20.....	45.	3.	$\frac{1}{2}$ dose	$\frac{1}{2}$ dose
20 to 60.....	60.	4.	$\frac{1}{2}$ dose	$\frac{1}{2}$ dose
60 and upward	45.	3.	$\frac{1}{2}$ dose	$\frac{1}{2}$ dose

The dose of thymol varies with the age of the patient. As the disease retards development and persons 18 years old often have only the normal growth of 13, apparent and not actual age determines the dose. A competent physician, of course, should supervise the treatment. The accepted scale of doses is shown by the accompanying table.

The thymol is powdered and given in capsules. If sugar of milk is added grain for grain, the thymol operates better.

In a majority of cases two treatments like the one just described will expel all the worms. In 1,518 out of 3,630 patients treated in Porto Rico, a single treat-



Fig. 16.—Showing effects of hookworm disease. Anemic ulcers commonly seen in cases of severe hookworm disease.

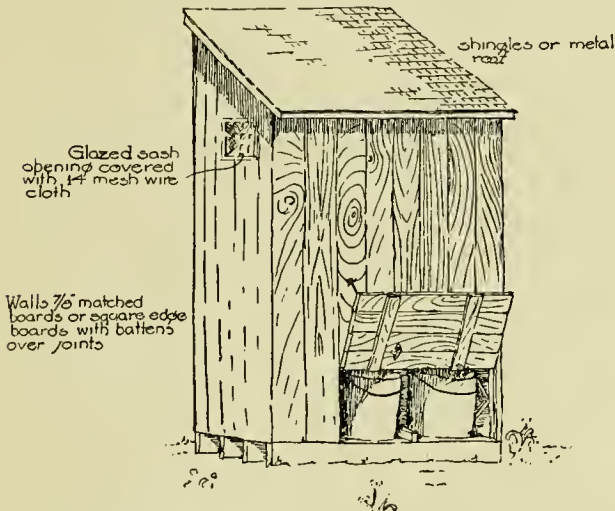


Fig. 17.—This shows a sanitary privy, designed to prevent the spread of disease. If a privy of this type were built on every farm and in every yard in villages, and if this privy were used by all persons, typhoid fever, hookworm disease, and various other maladies would almost or entirely disappear.

ment effected a cure; a second treatment was sufficient in 1,166 cases; 518 required a third; 247 a fourth; 104 a fifth; 47 a sixth, and so on until the last case was freed from hookworms by the eleventh treatment. Frequently the worms not killed by the thymol are sickened to a degree that they do not deposit any eggs for approximately two weeks. By a microscopic examination, made two weeks or longer after the last treatment, it is possible to know when all of the worms are destroyed, and the treatment completed. When a microscopic examination is not possible, the feces expelled by each treatment can be examined for hookworms in the manner already described. When no more worms are seen, one extra treatment for good measure should be given.

A HOOKWORM CATECHISM

Question. What are hookworms?

Answer. They are little white worms about half an inch long which live in the small intestines of human beings.

Q. Do they do any harm there?

A. Yes, they produce hookworm disease. Men, women and children attacked by these worms grow pale, weak and unable to work. The growth of children is stunted and they are made stupid in their studies. The worms suck people's blood and at the same time poison them.

Q. Do many people have it?

A. Yes, it is very common in the Southern states, and causes much misery and poverty. Often every member of large families has it, and frequently schools are found where from three-fourths to all the pupils have it.

Q. How do they get it?

A. Sometimes by eating raw food containing the newly hatched worms, generally by walking barefoot in dirty soil, and getting what is called "ground-itch."

Q. How do the young worms get in the soil or on food?

A. The full-grown worms can only live in the human bowel and there lay eggs. The eggs can only hatch after they are passed out with the excreta. When this is allowed to spread over damp earth the eggs hatch, and then while too small to be seen by the naked eye, will bore through the skin of anybody coming in contact with them, and finally reach the bowel where they in turn will grow up and produce eggs. Or they may stick to vegetables or fruit left on dirty ground and reach the bowel by being swallowed.

Q. Do the hookworms multiply in the bowel?

A. No, every single hookworm in the bowel was swallowed or has bored through the skin.

Q. Do the hookworms multiply on the ground?

A. No, every young worm on the ground is hatched from an egg passed from the bowel, and will die

ungrown unless it finds its way back into a human being. Break this circle and the hookworm disease is stamped out.

Q. How can it be broken?

A. By stopping *soil pollution*. First, build *sanitary privies*, which are tight, and do not let wastes reach the open ground. Second, *don't go barefooted*, but *wear shoes* and avoid contact with damp earth which may have been polluted with excrement. And do not let your fruit and vegetables lie on or be grown in such soil.

Q. Can hookworm disease be cured?

A. It can, easily. But it is better to prevent it.

Q. Is this also easy?

A. Yes, all that is needed is a good *tight privy* in every school, farm and cottage yard. Stop spreading excreta broadcast as is so commonly done in the Southern country. When everybody stops this dangerous habit, hookworm disease will die out. If you don't want hookworm disease, see that the wastes from your own home and school are safely disposed of in a *sanitary privy*, and, while teaching others to do the same, *wear shoes* and keep away from the earth which they may have allowed to become polluted.





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